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NOTES ON NORTH AMERICAN SPHAGNUM. I

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Descriptions of North American species of *Sphagnum* drawn up for the "North American Flora" call for a number of explanatory details beyond the scope of that work, and it is my purpose to embody such details in a series of notes, combining them with various suggestions which I trust may be of service to American bryologists in the study of the genus. That any revision of the genus must resolve itself very largely into a criticism of Warnstorf's views is so inevitable that I trust the fact will account for my frequent mention of that eminent bryologist's name.

I would at the outset expressly say that it is with the greatest personal regard for Herr Warnstorf and admiring recognition of his services to sphagnology that I find myself obliged to dissent from a good many of his published opinions.

I am indebted to the kindness of so many persons for material and for other favors that it is impossible to mention all here, but I shall have occasion to allude to many in the course of the notes. I am especially grateful to the directors of the New York Botanical Garden for a two months' fellowship in the summer of 1909, giving me access to the library and collections of the Museum, and to Mrs. Britton for her constant kindness and coöperation.

I. THE GROUPS

The first to attempt a division of the genus into subgenera was Lindberg, who in his invaluable monograph [1] proposed these subgenera 1. *Eusphagnum*, containing nearly all the species, 2. *Isocladus*, with *S. macrophyllum* and its synonym, *S. cribrosum*, and 3. *Hemitheca*, with *S. Pylaesii* and *S. cyclophyllum*.[2] The last two subgenera, separated in the one case by the lack of fibrils in the hyaline leaf cells, in the other by the form and texture of the capsule, have not maintained themselves, as the relationship of *S. Pylaesii* to *S. subsecundum* has long been recognized, *S. cyclophyllum* is perhaps not even specifically distinct from the same, and it may be added that *Sphagnum macrophyllum* appears also to find its nearest relative in this species.

A division of definitely permanent value was first established by Russow, who recognized a division into two groups[3] : I INOPHLOEA,

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1. Europas och Nord Amerikas Hvitmossor, Helsingfors, 1882.
2. The subgeneric names appear, accredited to Lindberg as sections, in Braithwaite's "Sphagnaceae of Europe and North America" 1880, while *Isocladus* (as a genus was proposed by Lindberg as early as 1862 (Ofvers. Kongl. Vet. Akad. Forh. **19:** 133).
3. Zur Anatomie der Torfmoose, Dorpat, 1887, p. 27 f.

II LITOPHLOEA, the latter with several subgroups. This division he based upon the fact that in I the cortical cells of stem and branches are fibrillose, i.e. have their walls inwardly beset by spirally ascending thickenings of the membrane, while in II this is never the case. As a matter of fact this is but one of several characters which separate these two very distinct types of *Sphagnum.*

The cortical branch-cells of I are relatively large and entirely homogeneous, the outer wall commonly containing a large round pore at upper end, sometimes also a second one below, while in II these cells are usually differentiated into two sorts, only the longer ones having a pore, and this terminating a longer or shorter neck-like extension of the cell-wall, the larger cells being then roughly flask- or retort-shaped; in the few species which show uniform cortical branch-cells, either the cells are all somewhat retort-shaped, or the retort-cells are almost or entirely suppressed.

A fundamental difference of leaf-structure finds its most conspicuous expression in the fact that the branch-leaves of *Inophloea* are cucullate, while those of *Litophloea* are never so, but toothed across a broader or narrower curved or truncate apex, a relation explaining in the former case the origin of the specific name, *S. cymbifolium,* and so of the current group name, *Cymbifolia* for *Inophloea.* In *Inophloea* the outer surface of the branch-leaf is roughened in the vicinity of its apex, as shown in Braithwaite's figures, a condition produced by the strongly projecting membrane of the hyaline cells, their outer membrane in this region being resorbed in a large gap in the end of the cell nearest the apex of the leaf, leaving the remaining membrane of the lower part of the cell projecting with marked convexity; this condition of things is entirely foreign to *Litophloea.* The leaves of *Litophloea* show furthermore border-differentiation not found in *Inophloea,* the margin, aside from the toothed apex, being bordered by two or more rows of narrower, thinner, cells; in *Inophloea* the network of alternating chlorophyll and hyaline cells simply ends with a chlorophyll-cell on whose outer side the so-called resorption-furrow represents the beginning of what would have been the next hyaline cell. If one look at the leaf-edge as the leaf lies flat on the slide, this remnant of the next hyaline cell appears as a very slender, nearly hyaline strip outside the last irregular line of chlorophyll-cells, somewhat broadened at cell-ends, where rudimentary traces of outwardly forking chlorophyll-cells give the margin a denticulate effect.

The stem-leaves as a further aspect of the same structural principle show in *Inophloea* the hyaline cells merely uniformly narrowed throughout the basal part of leaf, while *Litophloea* has invariably a side-border of several rows of narrow cells, and usually in addition a strong tendency to a suppression of the hyaline cells in the whole basal side regions (though the middle base always shows hyaline cells), a condition of things spoken of by Warnstorf in his descriptions as a strong broadening of the border downward.

In the perichaetial leaves the difference is carried still further, as in *Inophloea* the characteristic suppression of hyaline cells in favor of uniform long, narrow cells alone is confined to the basal and middle portion of the leaf, a generally broad lateral and apical region being formed of the normal network of chlorophyll-cells alternating with fibrillose hyaline ones ; in *Litophloea* on the other hand, if there be any such formation of a tissue of uniform narrow cells, it is in the basal, lateral, and apical region of the leaf, and may even occupy the whole; if it leave a portion with the normal network of alternating chlorophyll and hyaline cells, it is always the upper middle portion and the hyaline cells are here usually, but not in all species, without fibrils.

In proposing these two divisions as "groups," Russow evidently intended to express no opinion as to the relative rank of this category, except that it was of less than generic value, and Warnstorf retains his names as series (*"Reihen"*),[2] calling Russow's "subgroups" in this publication "sections." As the Vienna rules prescribe the ranking order: genus, subgenus, section, subsection (series, subseries), species, I am, I take it, making no essential change in designating Russow's groups as "subgenera." The names, as neuter plurals of adjective forms, do not agree with the recommendations of the Vienna Congress for subgeneric names. but can perhaps be regarded as substantivised feminine singulars. No species has been discovered showing intergrading forms, and the two lines are in every way so distinct that I have no doubt they may ultimately be recognized as separate genera.

Russow's "subgroups" were in no sense original with him, but represent simply a step in a long series of attempts to "arrange" the European species of *Sphagnum.* As a working-grouping of the European forms their value is beyond question and they are used with little change by Warnstorf. That they were not, however, final, is best shown by Warnstorf's not over successful attempt to apply them to the exotic species.[3] Of the ten groups recognized in this work *Sericea* and *Mucronata* are, it seems to me, ill founded; the western North American *S. mendocinum* so unites *Cuspidata* and *Subsecunda* that their separation becomes arbitrary ; the Central American *S. platycladum,* which clearly belongs with the *Acutifolia,* is placed with the *Truncata,* a group previously represented by the arctic *S. Aongstromii* alone, with which species it is far from being closely related ; and another member of the *Acutifolia,* the South American *S. gracilescens* is included among the *Subsecunda.* Warnstorf's mistakes only serve to illustrate how tentative the European grouping necessarily was, how closely related to each other most of these groups are, especially when their exotic species are included with them, and how impossible it becomes to devise any key that will separate them even by a single constant character.

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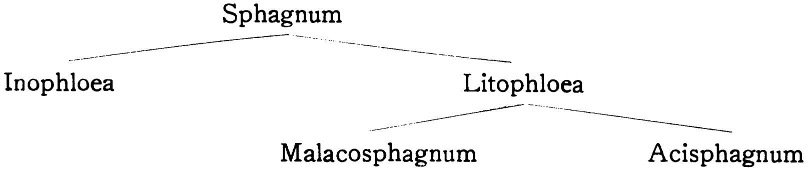
[2] Kryptogamenflora der Mark Brandenburg I. 1, p. 318 ff. 1903.

[3] Engler und Prantl, Die natuerlichen Pflanzenfamilien I. 3, I, p. 251 ff. 1900.

In this confusion of groups one stands out distinct in general appearance and certain anatomical characters, viz., the *Rigida*. This I have distinguished as an independent section, using the appropriate sectional name given it by Carl Müller in 1887,[4] *Malacosphagnum*. The other groups differ so very little from each other in comparison with their common difference from this group that I have not hesitated to include them in a single section, using for it the sectional name proposed by Carl Müller for the *Cuspidata*, viz. *Acisphagnum*. Of the disposition of its numerous species I shall speak later on.

The most characteristic feature of *Malacosphagnum* is its cortical branch-cells, which are homogeneous, all of the flask or retort type, though the neck may be very short and inconspicuous, while in *Acisphagnum* they are of two sorts. the retort-cells larger and occurring singly or in twos, one above the other, in the axils of the leaves. This difference is noted by Carl Müller (Berol.),[5] but has not previously been made a basis for classification. It forms a clearly recognizable diagnostic character separating two natural groups.

Of the two sections, *Malacosphagnum* seems both in general appearance and in the form and border of its leaves to be the more nearly related to *Inophloea*, without in any way bridging over the gap or invalidating the latter's claim to recognition as a subgenus. My conception of the natural relationship of these groups could be represented thus:



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Prof. Holzinger's exsiccati continue the high standard set in the earlier fascicles. This fascicle contains six species from the mountains of Colorado, including *Aulacomnium papillosum* (C. M.) Jaeg. and *Grimmia incurvata* Schwaegr. Coll. H. S. Jewett.

Eight from Montana, Coll. R. S. Williams, including *Roellia lucida* (E. G. Britton) Kindb., *Bryum capitellatum* C. M. & Kindb., *Grimmia*

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[4] Flora **70;** 404 C. M. had used some of his sectional names as substitutes for the current group-names for a number of years prior to this publication.

[5] Engler und Prantl, l. c., p. 181, f. 1894.